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Wireless Surveillance Robot using Automatic & Manual Control

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ABSTRACT: *A robot is an integration of mechanics, electronics and software. Robots are essentially a self-contained tribute to the wonders of technology. Robots if well designed in architecture and programmed with concepts of artificial intelligence can ease the human work. There are many different reasons for using a robot. Use of robots reduces labor and cost by automating recurring tasks. Human intervention is avoided hence less chances of errors and better accuracy can be expected. And most importantly the areas where human life can have risk, danger; at such places robots can navigate dangerous places and potentially save lives. The most advanced robotic models use fast computer processing, high-definition cameras, artificial intelligence and long-range sensors. They are used for surveillance. Our project is all about developing a wireless surveillance robotic vehicle which can navigate through obstacles with the help of sensors, embedded system and its programming. It will be able to capture the footage or pictures of area with its camera eye and send them back using wireless transmission technology such as Bluetooth.*

KEY WORDS: Android, Robot, Bluetooth, Robotic control, Wi-Fi, Surveillance, Artificial Intelligence, Arduino

I. INTRODUCTION:

This project is aimed at developing a surveillance system which can be controlled remotely by using an Android App. It includes a robot with a Wireless Camera attach to it. This robot captures the high resolution video feed and transmits it to the connected Android device which is used to control robot. [1]JOHANN BORENSTEIN AND YORAM KOREN paper is based upon a mobile robot system which has been developed for helping the physically disabled. It uses ultrasonic range finders for obstacle detection and mapping which are mounted on the vehicle. [2]Nils Gageik, Thilo Müller, Sergio Montenegro present a paper on their approach for obstacle detection and collision avoidance of an autonomous flying quad copter using low cost ultrasonic sensors and simple data fusion. [3]Gyula Mester's paper presents motion control in unstructured environments for mobile robots it proposes a fuzzy control of a wheeled mobile robot motion in unstructured environments with obstacles and slopes. [4]Kirti Bhagat, Sayalee Deshmukh's paper tells us that robot is a machine that can perform task automatically. Robotics is a combination of computational intelligence and physical machinery (motors). Computational intelligence involves the programmed instructions.

II. SCOPE:

As we are developing surveillance system, it can cover more region with its wheels. System we are designing will be dynamic in nature providing better surveillance results than the static surveillance appliances such as CCTV, where it just covers the limited area in less than 45 Degree angle. Our project is movable, so it can cover the area where the wheel will take the robot.

III. REQUIREMENTS:

Fig 1 – Arduino MEGA 2560

An Arduino is an open-source microcontroller development board. In plain English, you can use the Arduino to read sensors and control things like motors and lights. This allows you to upload programs to this board which can then interact with things in the real world. With this, you can make devices which respond and react to the world at large.

Fig 2 – Ultrasonic sensor HC-SR04

Ultrasonic transmitter emits an ultrasonic wave in one direction, and starts timing when it launches. Ultrasonic spreads waves in the air, and would return immediately when it encounters obstacles on the way. At last, the ultrasonic receiver would stop timing when it receives the reflected wave.

Fig 3 - ArduCAM

The ArduCAM USB camera shield is a universal camera control board designed for both PCs and embedded systems like the Raspberry Pi, TI Beaglebone, and similar products. It supports most parallel interface image sensors ranging from 0.3MP to 14MP, including both global and rolling shutter sensors.

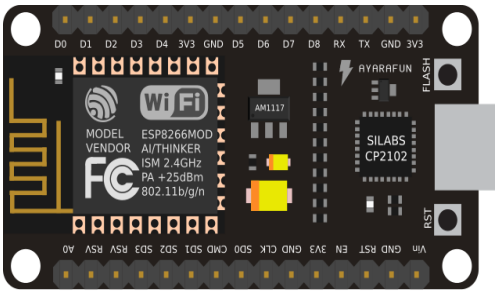

Fig 4 – Wi-Fi Module ESP 8266

ESP8266 is a Wi-Fi SOC (system on a chip) produced by Espressif Systems. It is a highly integrated chip designed to provide full internet connectivity in a small package.

Fig 5 – Bluetooth Module HC 05

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication.

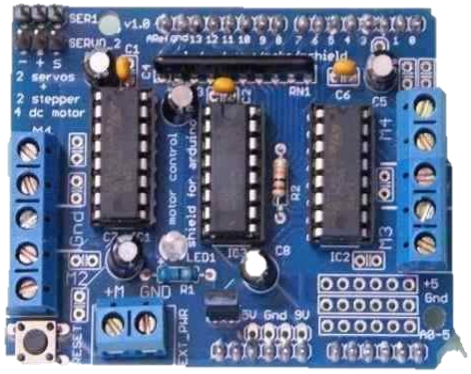

Fig 6 – Motor Driver Shield L298N

This motor controller from Tronixlabs Australia is based on the L298N heavy-duty dual H-bridge controller, which can be used to drive two DC motors at up to 2A each, with a voltage between 5 and 35V DC - or one stepper motor with ease. The controller has fast short-circuit protection diodes, and a nice heatsink to keep the L298N happy.

IV. IMPLEMENTATION:

The Figure. 7 shows the block diagram of Wireless Surveillance Robot.

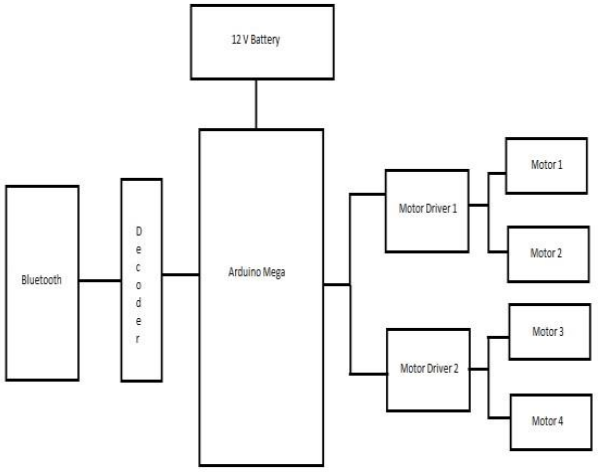

Fig 7 – Block Diagram of WSR

In that figure we can see that Bluetooth will send commands to Arduino mega by decoding it first, then Mega will perform operations on the basis of commands provided by the user & will give the output to Motor Driver Shield which will drive the respective DC motors.

Figure. 8 shows the Architecture of Wireless Surveillance Robot System.

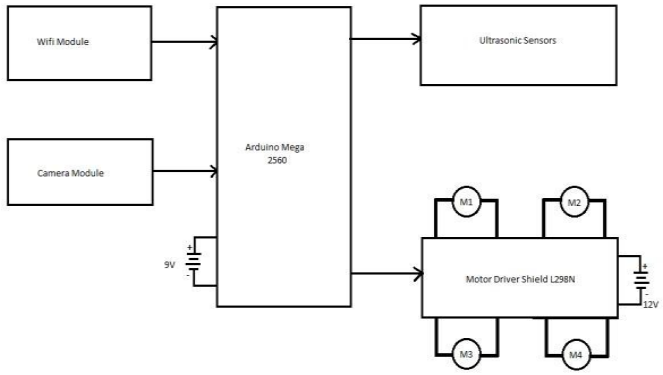

Fig 8 – Architecture of WSR

The major components which are required -

1. Arduino Mega 2560
2. ArduCam
3. Ultrasonic Sensors X 4
4. Bluetooth Module HC-05
5. Wi-Fi Module ESP8266
6. Motor Driver Shield L298N
7. DC Motors X 4

To make more useful & efficient surveillance system, we are using two transmission modules, Bluetooth & Wi-Fi. We are using Bluetooth Module to communicate with the system by using commands with the help of an Android Application. As we know to transmit data such as pictures & videos through live field requires more bandwidth, for that only reason we are using Wi-Fi module, because it provides more bandwidth for transmission than Bluetooth.

The system is divided into two major parts, User Interface & Wireless Surveillance Robot. In this, User Interface is responsible for getting access & commands from the user which will be connected to the robot through Bluetooth module to perform actions & Wi-Fi to get the desired output of surveillance. Performance Parameters are:

Speed
Image Resolution
Noise
Connectivity Range
Ultrasonic Sensor Range
Compact Design
Camera Angle
Response Time
Terrain

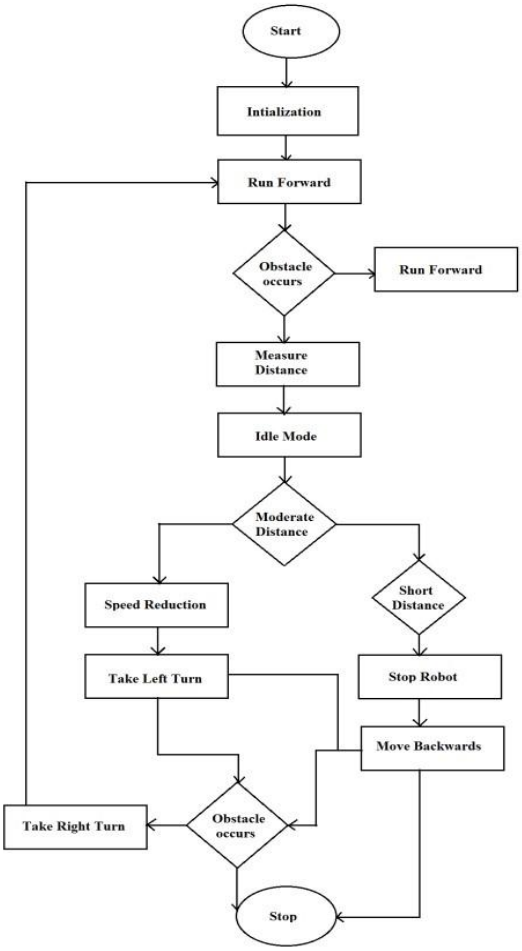

Fig 9 – Flowchart of the WSR

V. CONCLUSION:

In a nutshell we can conclude that wireless surveillance robot can certainly be a future market for many defense and security purposes like military reconnaissance mission, wireless security and surveillance in hot spots, search and rescue operations or maneuvering in hazardous environment. This can save valuable human lives as well as time and resources need for such operations. We can use both Bluetooth and Wi-Fi for manual control and transmission of video footage depending on the purpose of the surveillance. Further enhancements can be added to improve functionality and features, which will further reduce human efforts and resources.

ACKNOWLEDGEMENT:

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